Review

Scientific Notation

Express each number in standard form.

1. 1.5×10^3 1500
2. 4.01×10^4
3. 6.78×10^2 678
4. 5.925×10^6
5. 7.0×10^8 700,000,000
6. 9.99×10^7
7. 3.0005×10^5 300,050
8. 2.54×10^5
9. 1.75×10^4 17,500
10. 1.2×10^{-6}
11. 7.0×10^{-1} 0.7
12. 6.3×10^{-3}
13. 5.83×10^{-2} 0.0583
14. 8.075×10^{-4}
15. 1.1×10^{-5} 0.000011
16. 7.3458×10^7

Express each number in scientific notation.

17. 1,000,000 $1 * 10^6$
18. 17,400
19. 500 $5 * 10^2$
20. 803,000
21. 0.00027 $2.7 * 10^{-4}$
22. 5300
23. 18 $1.8 * 10^1$
24. 0.125
25. 17,000,000,000 $1.7 * 10^{10}$
26. 0.01
27. 21,800 $2.18 * 10^4$
28. 2,450,000
29. 0.0054 $5.4 * 10^{-3}$
30. 0.000099
31. 8,888,800 $8.8888 * 10^6$
32. 0.00912

Choose the greater number in each pair.

33. 8.8×10^3, 9.1×10^{-4}
34. 5.01×10^2, 5.02×10^{-1}
35. 6.4×10^3, 900 $9 * 10^2$
36. 1.9×10^{-2}, 0.02
37. 2.2×10^{-3}, 2.1×10^2
38. 8.4×10^2, 839

Order each set of numbers from least to greatest.

39. 3.6×10^4; 5.8×10^{-3}; 2.1×10^6; 3.5×10^5

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Objectives: I can simplify expressions involving numbers expressed in scientific notation.

Operations with Numbers Expressed in Scientific Notation

Multiplication

When numbers in scientific notation are multiplied, only the number is multiplied. The exponents are added.

$(2.00 \times 10^{3})(4.00 \times 10^{5}) = (2.00)(4.00) \times 10^{3+4}$ ← Rule: Multiplying → add exponents!

Keep base
Add exponents

$= 8.00 \times 10^{7}$

Division

When numbers in scientific notation are divided, only the number is divided. The exponents are subtracted.

$\frac{9.60 \times 10^{7}}{1.60 \times 10^{4}} = \frac{9.60}{1.60} \times 10^{7-4}$ ← Rule: Division: Subtract the exponents!

keep base
subtract exponents

$= 6.00 \times 10^{3}$

Note: The first term
↓
$1 \le n < 10$
must be between 1 and 10!

Perform the following operations and express the answers in scientific notation.

a. $(4.3 \times 10^{8}) \times (2.0 \times 10^{6}) = (4.3)(2.0) * 10^{8+6} = \boxed{8.6 * 10^{14}}$ ⓐ answer

b. $(6.0 \times 10^{3}) \times (1.5 \times 10^{-2})$ $(6)(1.5) * 10^{3+(-2)}$ $9 * 10^{1}$ $= \boxed{9 * 10^{1}}$ ⓑ answer

c. $(1.5 \times 10^{-2}) \times (8.0 \times 10^{-1})$ $(1.5)(8) * 10^{-2+(-1)}$ $12 * 10^{-3}$

First term adjustment → 12

adjust 12 $1.2 * 10^{1} * 10^{-3}$

$1.2 * 10^{1+(-3)}$

$\boxed{1.2 * 10^{-2}}$ ⓒ answer

d. $\frac{7.8 \times 10^{3}}{1.2 \times 10^{4}}$ $6.5 * 10^{3-4} = \boxed{6.5 * 10^{-1}}$ ⓓ answer

e. $\frac{8.1 \times 10^{-2}}{9.0 \times 10^{2}}$ adjust 0.9 → $9 * 10^{-1} * 10^{-2-2} = 9 * 10^{-1} * 10^{-4} = \boxed{9 * 10^{-5}}$ ⓔ answer

f. $\frac{6.48 \times 10^{5}}{(2.4 \times 10^{4})(1.8 \times 10^{-2})}$

Step 1: Simplify the denominator (multiply)

$(2.4)(1.8) * 10^{4+(-2)}$

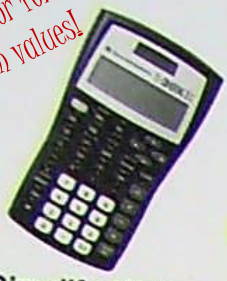
$4.32 * 10^{2}$

$\frac{6.48 * 10^{5}}{4.32 * 10^{2}} = \frac{6.48}{4.32} * 10^{5-2}$

Step 2: Divide

$= \boxed{1.5 * 10^{3}}$ ⓕ ANSWER

Use a calculator for the first term values!



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NOTE: If the first term is not $1 \le n < 10$ between 1 and 10... ADJUST and re-write in scientific notation!

Operations with Scientific Notation

Simplify. Write each answer in scientific notation. Round to three significant digits if needed.

1) $\frac{4.6 \times 10^{-3}}{3 \times 10^{6}}$ Division — subtract

$\frac{4.6}{3} * 10^{-3+(+6)}$ add the opposite! $(-3+6)$

1.53×10^{3}

2) $(9 \times 10^{-5})(7.07 \times 10^{-3})$ multiplication — add

$(9)(7.07) \times 10^{-5+(-3)}$

adjust 63.63×10^{-8}

$6.363 \times 10^{1} \times 10^{-8} = 6.363 \times 10^{1+(-8)}$

$= 6.363 \times 10^{-7}$

3) $\frac{5 \times 10^{4}}{3 \times 10^{6}}$ (−) division

$\frac{5}{3} \times 10^{4-3}$

1.67×10^{1}

4) $\frac{9.9 \times 10^{-5}}{1.3 \times 10^{-6}}$ (−) division

$\frac{9.9}{1.3} \times 10^{-5+(+6)}$ $-5+6$

7.62×10^{1}

5) $(5.8 \times 10^{-6})(6 \times 10^{-3})$

6) $(3.24 \times 10^{-4})(4.21 \times 10^{-6})$

7) $(5 \times 10^{6})(2.6 \times 10^{2})$ Multiplication — Add the exponents

$(5)(2.6) \times 10^{6+2}$

adjust 13

$1.3 \times 10^{1} \times 10^{8} = 1.3 \times 10^{1+8}$

$= 1.3 \times 10^{9}$

8) $\frac{6.74 \times 10^{-5}}{9 \times 10^{3}}$ (−) Division

$\frac{6.74}{9} \times 10^{-5+(+3)}$ $-5+3$

adjust $.749 \times 10^{-2}$

$7.49 \times 10^{-1} \times 10^{-2}$ add; $-1+(-2)$

7.49×10^{-3}

9) $(3.6 \times 10^{3})(5.1 \times 10^{4})$ — add

Multiplication $(3.6)(5.1) \times 10^{3+4}$

adjust 18.36×10^{7}

$1.836 \times 10^{1} \times 10^{7}$ (+)

1.836×10^{8}

10) $(9.1 \times 10^{5})(3.2 \times 10^{3})$ — add

Multiply $(9.1)(3.2) \times 10^{5+3}$

adjust 29.12×10^{8} (+)

$2.912 \times 10^{1} \times 10^{8}$

2.912×10^{9}

11) $\frac{9.7 \times 10^{3}}{5 \times 10^{4}}$

12) $\frac{5.04 \times 10^{4}}{2.2 \times 10^{2}}$